

REMARKS

By this amendment, Applicant has amended claims 1 and 2 to further define the invention. In particular, claims 1 and 2 have been amended to recite that the apparatus includes a unit for maintaining the separation column at a first predetermined temperature higher than room temperature and a unit for maintaining the reduction column at a second predetermined temperature higher than room temperature. See, for example, the temperature-controlled tanks 132 and 142 in Figure 1 and the disclosure in the paragraph bridging pages 7 and 8 and the first paragraph on page 8 of Applicants' specification (the third and fourth full paragraphs on page 6 of the substitute specification).

The foregoing amendments place the application in condition for allowance the reasons set forth hereinafter. Therefore, entry of this amendment under 37 CFR 1.116 is requested.

Applicant, through its undersigned attorney, thanks the Examiner, Shogo Sasaki, for the telephone interview courteously granted to the undersigned on even date. During the interview, the foregoing amendments to the claims and the differences between the presently claimed invention and the prior art would be discussed. Those differences are set forth more fully hereinafter.

The interpretation of the claims in numbered section 2 of the Office Action is traversed. The Office Action alleges that the limitations "configured to ..." are directed to the manner in which the claimed apparatus is intended to be used, do not distinguish the claimed apparatus from the prior art and do not further structurally limit the claimed apparatus. However, the fact that, for

example, the reduction column of claim 1 is configured to receive four separate nitropolycyclic aromatic hydrocarbons from the separation column requires that, *inter alia*, the separation column and reduction column be connected in a manner that the reduction column receives the at least four separate nitropolycyclic aromatic hydrocarbons from the separation column. This is clearly a structural limitation on the apparatus and is more than a mere recitation of intended use. Therefore, it is submitted the interpretation of the claims in numbered section 2 of the Office Action is improper.

The Examiner has objected to the specification in numbered section 3 of the Office Action as failing to provide proper antecedent basis for the claimed subject matter. In support of this, it has been urged that a separation column specifically designed to separate a sample into four specific isomers of nitro-PAH lacks antecedent basis. Applicant traverses this objection and requests reconsideration thereof.

The present claimed invention relates to an apparatus for analyzing nitropolycyclic aromatic hydrocarbons and includes a separation column configured to separate the sample containing nitropolycyclic aromatic hydrocarbons into at least four separate nitropolycyclic aromatic hydrocarbons. It is noted the claims no longer call for a separation column to separate a sample into four specific "isomers." Support for the claims as presently amended, including the presently claimed separation column, can be found at, e.g., the third full paragraph on page 6 of the Substitute Specification.

Accordingly, reconsideration and withdrawal of the objection to the

specification in numbered section 3 of the Office Action are requested.

Claims 1 and 9 stand rejected under 102(b) as allegedly being anticipated by JP 2001-021497 to Iwabuchi et al. Claim 15 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Iwabuchi et al. Applicant traverses this rejection and requests reconsideration thereof.

The rejected claims relate to an apparatus for analyzing nitropolycyclic aromatic hydrocarbons. The apparatus includes an auto-sampler to which a methanol water mixture and a sample comprising nitropolycyclic aromatic hydrocarbons are sent; a separation column downstream of the auto-sampler configured to receive the methanol water mixture and the sample from the auto-sampler and configured to separate the sample containing nitropolycyclic aromatic hydrocarbons into at least four separate nitropolycyclic aromatic hydrocarbons including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene; a reduction column downstream of the separation column configured to receive the at least four separate nitropolycyclic aromatic hydrocarbons including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene from the separation column and to aminate the separated nitropolycyclic aromatic hydrocarbons; and a fluorescence detector. The apparatus also includes units for maintaining the separation column and for maintaining the reduction column at first and second predetermined temperatures higher than room temperature. See, claim 1. The apparatus can also include an analysis column for separating an interfering component contained in the sample from the aminated separated nitropolycyclic aromatic hydrocarbons. See, claim 2.

As described at the paragraph bridging pages 2 and 3 of Applicant's Substitute Specification, the Iwabuchi et al. publication discloses a nitrogen-containing organic substance analyzer comprising a reduction column for reducing the nitrogen-containing organic substance, a separation column for separating the nitrogen-containing organic substance, a means for adding a reaction reagent to the reduced and separated nitrogen-containing organic substance for causing chemiluminescence emission for detection, and a means for setting the reduction column arbitrarily to a temperature within the range of 90 to 150° C., so that the nitrogen-containing organic substance is reduced within the temperature range of 90 to 150° C.

The Office Action appears to equate the reduction column 17 of Iwabuchi et al. to the reduction column of the present invention. However, it appears the reduction column 17 of Iwabuchi et al. reduces the nitroarene from separation column 9. Based on the English abstract of Iwabuchi et al., it appears the polycyclic aromatic component from separation column 9 is sent to a separation column 10, not to the reduction column 17. Thus, it does not appear the reduction column 17 of Iwabuchi et al. is configured to receive at least four separate nitropolycyclic aromatic hydrocarbons from the separation column and to aminate the separated nitropolycyclic aromatic hydrocarbons.

In addition, Iwabuchi discloses a reduction column that is kept warm, but not a separation column that is kept warm. In Iwabuchi, a sample sent from a pump 5 and a sampler 7 remains in a separation column 9, a flow of the sample and an eluent 2 is changed by a pump 6 and is sent to a reduction column 17. Therefore, Iwabuchi fails to disclose a configuration allowing a

sample and an eluent to be supplied to the separation column and the reduction column from the auto-sampler. Thus, the present invention differs from Iwabuchi in that the methanol water and nitropolycyclic aromatic hydrocarbons are kept warm in the both the separation column and the reduction column at the predetermined temperature and sent out by the auto-sampler, so that the present invention is able to detect with high accuracy the nitropolycyclic aromatic hydrocarbons contained in diesel particles from the exhaust of diesel engines.

For the foregoing reasons, it is submitted the presently claimed invention is patentable of Iwabuchi et al.

Claims 1, 9 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the article Li et al. Applicant traverses this rejection and requests reconsideration thereof.

The Li et al. article discloses that the determination of mono- and di-nitro polycyclic aromatic hydrocarbons (PAHs) was accomplished by on-line reduction to the corresponding amino PAHs, which were then separated and detected using high-performance liquid chromatography (HPLC) and chemiluminescence detection. On page 179 of this article, chromatograms are shown in which 2(A) is a chromatogram of a standard mixture. Peaks: 1 = 1,8- dinitropyrene, 2 = 2-nitroanthracene, 3 = 1-nitropyrene, 4 = 6-nitrocrysene, 5 = 3-nitroperylene and 6 = 1-nitroperylene, (B) and (C) are chromatograms of a diesel particulate extract from fractions containing mono-nitro PAHs and di-nitro PAHs, respectively, and (D) and (E) are chromatograms of a diesel exhaust emission filter extract sample from

fractions containing mono-nitro PAHs and di-nitro PAHs, respectively.

While the introduction of Li et al. mentions that "great attention has been directed to 1-nitropyrene and 1, 3-, 1, 6- and 1,8-dinitropyrenes," it does not appear that the Li et al. article discloses a separation column for separating a sample comprising nitropolycyclic aromatic hydrocarbons into at least four separate components including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene. Rather, in Li et al, the nitro PAHs are first reduced to amino PAHs using a catalyst column (see, the section 2.3 bridging pages 178 and 179 of Li et al). It is the amino PAHs that are separated by chromatographic separation (see, section 2.4 on page 179 of Li et al). Accordingly, the Li et al. article does not disclose and would not have rendered obvious the presently claimed invention including a separation column configured to separate a sample containing nitropolycyclic aromatic hydrocarbons into at least four separate nitropolycyclic aromatic hydrocarbons including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene.

Moreover, the separation column in Li et al. is not disclosed to be a silica gel/C8 separation column, as now recited in claims 15 and 16.

The present invention also includes an auto-sampler to which a methanol water mixture and the sample comprising nitropolycyclic aromatic hydrocarbons are sent. The separation column is configured to receive the methanol water mixture and the sample from the auto-sampler. On the other hand, in Li et al., the methanol water mixture and the sample are sent first to the catalyst column. It is disclosed that "[b]ecause the methanol-water

solution is not appropriate to the chemiluminescence detection system, it is necessary to change to an acetonitrile-buffer solution as mobile phase by using a switch valve." The chromatographic separation of the amino compounds is then carried out in Li et al. using the acetonitrile-buffer solution; the chromatographic separation column does receive the sample and methanol water mixture from an auto-sampler.

Moreover, according to the present invention, the reduction column is configured to aminate the separated nitropolycyclic aromatic hydrocarbon is downstream of the separation column. The opposite is true in Li et al. On-line reduction using a catalyst column is first carried out and then chromatographic separation is carried out downstream of the catalyst column.

For the foregoing reasons, the apparatus of the present invention is clearly not disclosed and would not have been obvious from Li et al.

Claim 17 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Iwabuchi et al. or Li et al in view of Collins or Anthony. Applicant traverses this rejection and requests reconsideration thereof.

Neither Iwabuchi et al. nor Li et al discloses or would have rendered obvious the apparatus for analyzing nitropolycyclic aromatic hydrocarbons set forth in claim 1 for the reasons noted above and clearly do not disclose or suggest the apparatus set forth in dependent claims 17 and 18, including an ultrasonic generator provided upstream of the auto-sampler for applying ultrasonic waves to a mixture of diesel particulates and an organic solvent to dissolve soluble organic fractions of the diesel particulates in the organic solvent.

While the office action cites Collins and Anthony as disclosing ultrasonic solvent extraction of solubles from solid samples, such extraction is completely unrelated to an apparatus for analyzing nitropolycyclic aromatic hydrocarbons. Accordingly, it is submitted there would not have been any apparent reason to combine the teachings of Collins or Anthony with those of Iwabuchi et al. nor Li et al. Therefore, claims 17 and 18 are patentable over the proposed combination of documents.

In view of the foregoing amendments and remarks entry of this amendment, and favorable reconsideration and allowance of all the claims now in the application are requested.

Please charge any shortage in the fees due in connection with the filing of this paper, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 648.45478X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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